

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE



Group Art Unit: 1771  
Examiner: E. Cole  
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Re Application of:

Serial No.:

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GARY A. HARPELL ET AL.

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For: **FLEXIBLE FABRIC FROM FIBROUS WEB AND DISCONTINUOUS DOMAIN MATRIX**

Colonial Heights, VA 23834  
May 20, 2002

Assistant Commissioner for Patents  
Washington, D.C. 20231

Sir:

DECLARATION

In conjunction with the above-identified patent application, I have been asked to comment on whether the following statement may be interpreted as referring to a number-average molecular weight.

"Ultra-high molecular weight polyethylene's are generally understood to include molecular weights of from about 500,000 or more, more preferably from about 1 million or more, and most preferably greater than about 2 million, up to an amount of approximately 5 million."

I conclude that a number-average molecular weight interpretation is both not sensible and unlikely to be considered by workers in the field for the following reasons:

1. It cannot be measured. Classical, absolute molecular weight determination methods do not have the sensitivity to measure number-average molecular weights for typical, unfractionated polyethylene samples greater than or equal to 500,000. Although gel permeation chromatography (also called size exclusion chromatography) with certain detectors permits number-average molecular weight determination of this magnitude for some polymers, it has been shown to be not applicable for this purpose for polyethylene of these molecular weights. [H. L. Stein, "Ultra High Molecular Weight Polyethylene", in Engineered Materials Handbook, ASM International, (Materials Park, OH), 1999].

2. It violates standard terminology in the area. Dilute solution viscosity measurements are the routine method to determine the molecular weight of UHMWPE. Measured intrinsic viscosity values (from a process such as ASTM D-4020-92 from the

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American Society for Testing and Materials) are converted to molecular weights by a Mark Houwink equation. This relation is derived from independent measurements of molecular weight and intrinsic viscosity of narrow-distribution, calibration samples. The Polymer Handbook [M. Kurata and Y. Tsunashima "Viscosity-Molecular Weight Relationships" VII-1, Brandrup, E. H. Immergut, eds.; Willey-Interscience, (New York), 1989] lists several typical relations. Relations they select as the most reliable measure the weight-average molecular weight of narrow-distribution calibration samples of low-density polyethylene (LDPE) and ULDPE by light scattering. Since the fractions are narrow, all molecular weight averages of each calibration fraction are close to one another. The molecular weight average obtained when applying the Mark Houwink relation to a broad unknown-distribution sample is a viscosity-average molecular weight, which is recognized in both theory and practice to be "close to the weight-average molecular weight." [D. L. Beach and Y. V. Kissen, "Ultrahigh Molecular Weight Polyethylene" in Encyclopedia of Polymer Science and Engineering, H. F. Mark, et al., eds.; Willey-Interscience, (New York), 1986]

As pointed out in ASTM test method D4020, "It has been common practice to refer to the 'molecular weight' of UHMW-PE resins." In Note 1 of this method the analyst is instructed to use a Mark Houwink expression to specify what is identified as a "nominal molecular weight." Note that the citation of any type of average is not included in their "common-practice" terminology. I expect one of ordinary skill in the art would apply this same reasoning while reading this patent and interpret the molecular weight specifications as weight-average molecular weights.

My Curriculum Vita is attached.

All statements made herein of my or our own knowledge are true and all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like are punishable by fine or imprisonment, or both, under §1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.



M. E. McDonnell  
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May 20, 2002

## CURRICULUM VITA

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Education: 1974 Ph.D. Physics University of Delaware  
1968 B.S. Physics Dickinson College

### Work Experience:

1996 - Principle Scientist, Corporate Research and Development, AlliedSignal /  
Honeywell, Morristown, NJ  
1986 - 1996 Research Scientist, Corporate Research and Technology, AlliedSignal,  
Morristown, NJ  
1983 - 1986 Senior Staff Scientist, Water Treatment Polymers, AlliedSignal, Syracuse,  
NY  
1977 - 1983 Associate Professor, Department of Physics, West Virginia University,  
Morgantown, WV  
1974 - 1977 Senior Research Associate, Macromolecular Sciences, Case Western  
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### Recognition:

2000 Black Belt Certification for On-Line pH Monitoring / Sampling of Naproxen in  
The Bahamas  
1999 Black Belt candidate for training in advanced Six Sigma skills  
1998 Corporate Special Recognition Award for Six Sigma work at Baton Rouge South  
Works  
1998 Analytical Achievement Award for Plastics Education Program course  
development  
1998 Analytical Achievement Award for laboratory process improvement for  
refrigerant blends  
1997 Process Improvement Leader Certification  
1997 Analytical Achievement Award for new product support to Specialty Chemicals  
1995 Research and Technology Team Recognition Award for Honda break support  
1995 Total Quality Facilitator Certification  
1994 Research and Technology Team Recognition Award for Aclar laminate  
thermoformability

1993 Analytical Achievement Award for support of bipolar membrane development

Professional Affiliations: American Chemical Society  
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